Document title: **Flooding Volume for Room P-0123A in the PT Facility**

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History Sheet

Rev	Date	Reason for revision	Revised by
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Contents

Appendices

Acronyms and Abbreviations

AEA	Atomic Energy Act of 1954
DOE	US Department of Energy
FRP	feed receipt process
HLP	HLW lag storage and feed blending process
HLW	high-level waste
LAW	low-activity waste
MSM	master-slave manipulator
PT	pretreatment
PIH	pretreatment in-cell handling
PWD	plant wash and drain
RDMC	remote decontamination maintenance cave
WAC	Washington Administrative Code

1 Introduction

The Washington Administrative Code, WAC 173-303-640(4)(e), addresses tank systems containing dangerous waste. This code requires that secondary containment systems be designed to contain 100 % of the capacity of the largest tank within its boundary. Also included is the containment of the fire water discharge, where applicable, within the boundary of the secondary containment.

This report specifically addresses flooding scenarios to be contained within the pretreatment (PT) facility Room P-0123A and establishes the minimum requirements for secondary containment. This room contains the Remote Decontamination Maintenance Cave (RDMC) which is part of the Pretreatment In-Cell Handling (PIH) System.

2 Applicable Documents

WAC 173-303, *Dangerous Waste Regulations*, Washington Administrative Code

3 Description

The PT facility receives low-activity waste (LAW) feed and high-level waste (HLW) feed from the Double-Shell Tank System. This mixed waste feed is pumped through double-walled underground transfer lines to the PT facility.

The purpose of the PT facility is to pretreat the waste received from the Double-Shell Tank System and to transfer it to the LAW and the HLW vitrification facilities. Within the LAW and HLW vitrification facilities, the waste is formed into glass logs suitable for long-term disposal.

Within the PT facility, the LAW feed is transferred to the waste feed receipt process (FRP) vessels (FRP-VSL-00002A/B/C/D), while the HLW feed is sent to the HLW feed receipt vessel (HLP-VSL-00022). These wastes are temporarily stored in the vessels before being pumped and treated by the PT processing equipment.

These vessels are located in black cells and are not accessible. The black cells are arranged in a "U" shape around a central hot cell in the PT facility, where major processing equipment is located.

The hot cell is remotely maintainable with the use of a crane system. Below the center of the hot cell are two adjacent rooms in the deep pit at the -45 ft elevation. This is the low point for the PT facility. Within these rooms are the plant wash and disposal (PWD) ultimate overflow vessel (PWD-VSL-00033) and the HLW effluent transfer vessel (PWD-VSL-00043).

The FRP vessels are the largest in the PT facility. The flood scenario at 0 ft elevation addressed a postulated failure of one FRP vessel and the movement of its fluid from a black cell to the hot cell, and then to the -45 ft elevation pit in *Flooding Volume for Below Grade and 0 Ft Level in PT Facility* (24590-PTF-PER-M-02-005). The flooding scenario also addressed the fire water pit at the -19 ft elevation. The

0 ft elevation flooding document did not specifically address the flooding volume in Room P-0123A, which is addressed in this document.

3.1 Room P-0123A Flooding Volume

Room P-0123A is located on the east end of the hot cell (Room P-0123) in the PT facility and houses the Remote Decontamination Maintenance Cave (RDMC). The RDMC provides shielded windows for direct viewing, master-slave manipulators (MSMs), and jib cranes for enhanced equipment handling capabilities. The RDMC includes five areas separated by function. The Spray Decontamination Area provides remotely deployed lances to clean and decontaminate equipment surfaces. The Size Reduction Area provides the equipment needed to cut process components or other handling equipment into more manageable pieces. The Soak Decontamination Area provides decontamination equipment to clean and decontaminate the internals of failed equipment. MSMs and remote handling tooling are deployed in the Remote Repair Area for performing maintenance on items that cannot be decontaminated sufficiently for direct or indirect hands-on maintenance. Finally, the Laydown Area provides temporary storage of contaminated components and local storage of contaminated tools and fixtures.

The entire cell floor of Room P-0123A is lined with stainless steel, and the walls are lined up to 18 ft (for spray decontamination operations). A stainless steel lined stub wall (4 ft 8 in high) on the west end of the RDMC separates the RDMC room from the hot cell. Two sumps (PWD-SUMP-00032 and PWD-SUMP-00033) are located in Room P-0123A and the floor of the room slopes toward the sumps. Room P-0123A does not have floor drains and in the event of flooding, the liquid is removed from the room via two steam ejectors located in the sumps. The room is not serviced by fire protection sprinklers.

The Soak Decontamination Area within the RDMC contains a Decontamination Tank (PIH-TK-00001). This is the only tank in Room P-0123A.

The evaluation of flooding volume, which is provided in Appendix A, determines the flooding volume for Room P-0123A and determines the minimum height for the stainless steel liner.

The flooding volume is determined from the volume of the largest vessel within the containment. Firewater discharge is not applicable to this room.

The results of the evaluation indicate a flood volume of 231 cubic feet and a required minimum liner height that is 2-inches above the highest point of the grout or 16-inches referenced to the 0' 0'' concrete elevation (Elevation 1' 4").

Appendix A
Evaluation of Flooding Volume for Room P-0123A

Appendix A
Evaluation of Flood Volume for Room P-0123A

Description

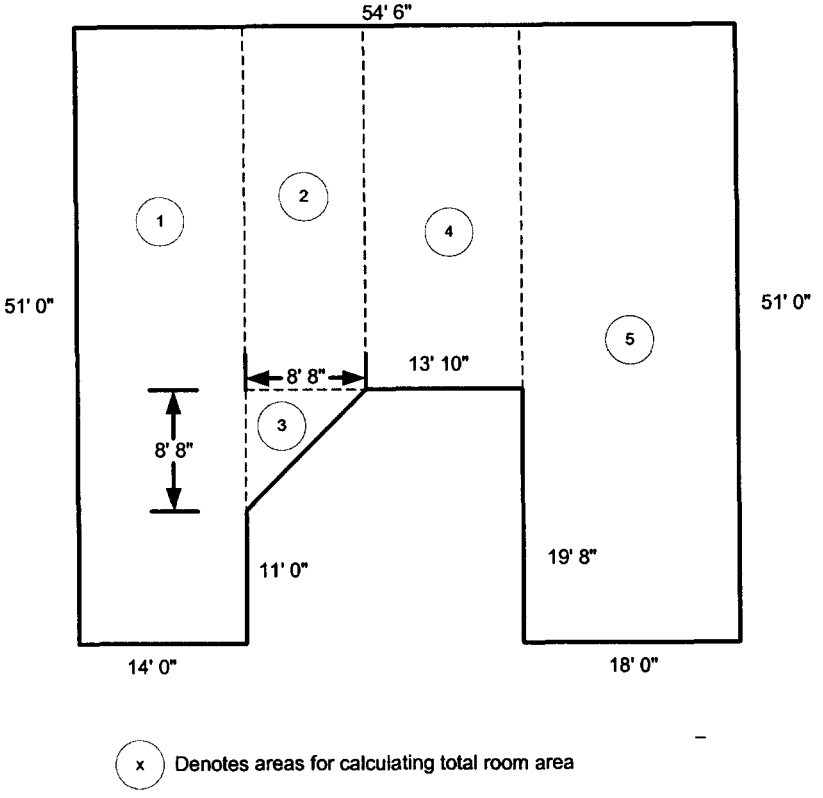
Room P-0123A is located on the east side of the PT facility hot cell and houses the Decontamination Tank (PIH-TK-00001). The Decontamination Tank is the only vessel in the room. The secondary containment for Room P-0123A includes two low point sumps (PWD-SUMP-00032, and PWD-SUMP-00033) and a stainless steel liner. The floor of the room is sloped towards the sump. Room P-0123A does not have floor drains; in the event of flooding, the liquid is removed from the room through two steam ejectors provided at the floor sump. The room does not have sprinklers.

This evaluation determines the flooding volume for Room P-0123A and determines the minimum height for the stainless steel liner.

Basis

- The dimensions of Room P-0123A are provided in Figure 1 below.
- The dimensions of PIH-TK-00001 are 96 inches diameter by 55 inches tall
- The volume of PWD-SUMP-00032 is 73.5 gallons
- The volume of PWD-SUMP-00033 is 73.5 gallons
- The maximum height of grout in Room P-0123A is 14 inches above the 0'-0" elevation concrete.

Figure 1 - Dimensions of Room P-0123A



Method

The flooding volume is determined from the volume of the largest vessel within the containment.

The minimum height for the liner is based on the flooding volume. Since the slope of the floor will direct water to the sump, credit is taken for the sump volume. The resulting net volume is divided by the available room area. The total room area is reduced by the footprint of the enclosed equipment to determine the available room area. The height of the liner will be determined from the height of the grout; for conservatism, no credit is taken for the volume created by the slope of the floor.

Determination of Flood Volume

From the dimensions of PIH-TK-00001, the vessel volume contribution to flooding volume, Vv, is calculated from:

$$Vv = \pi/4 \times Dv^2 \times Hv$$

Where:

Dv = Vessel diameter, feet = 96 inches / 12 inch/ft = 8 ft

Hv = Vessel height, feet = 55 inches / 12 inch/ft = 4.6 ft

Then

$Vv = \pi/4 \times (8\ ft)^2 \times (4.6\ ft) = 231.2\ cu\ ft$

The flooding volume, Vflood, is:

Vflood = Vv = 231.2 cu ft

Rounding to the nearest integer gives

Vflood = 231 cu ft

Determination of Minimum Liner Height

The total room area is calculated as the sum of areas 1-5 (denoted by circles in Figure 1 above) as follows:

A1 = 14' 0" x 51' 0" = 714 ft2

A2 = 31' 4" x 8' 8" = 271.6 ft2

A3 = 1/2 x 8' 8" x 8' 8" = 37.6 ft2

A4 = 13' 10" x 31' 4" = 433.4 ft2

A5 = 18' 0" x 51' 0" = 918 ft2

Total room area At = A1+A2+A3+A4+A5 = 2374.6 ft2 (round to 2375 ft2)

The available area for containment excludes the area occupied by the equipment. For PIH-TK-00001, the footprint area of the vessel, Av, is:

$Av = \pi/4 \times Dv^2 = \pi/4 \times (8\ ft)^2 = 50.3$ sq ft (round to 50 sq ft)

Where Dv = diameter of vessel in ft

For the other equipment in the room, the footprint is estimated as follows:

Decon turntable	PIH-TTBL-00001	20 sq ft
Repair turntable	PIH-TTBL-00002	95 sq ft
Miscellaneous area for baskets*, tools, equipment laydown, etc.		
(allow 5% of total floor area)		120 sq ft

*Note: Basket Staging Frame (PIH-MHAN-00015) has no significant footprint and is therefore neglected.

Subtotal component footprint, Ae	235 sq ft

The available area, Aa, is determined from:

Aa = At - Av - Ae = 2375 sq ft - 50 sq ft - 235 sq ft = 2090 sq ft

The volume of each of the two sumps is:

Vsump = 73.5 gal / 7.48 gal/cu ft = 9.8 cu ft

As stated in the method section, for conservatism, the volume created within the sloped area of the floor is neglected.

The minimum liner height, Lmin, above the height of the grout, is

Lmin = (Vflood - 2Vsump) / Aa = (231 cu ft - 2 x 9.8 cu ft) / 2090 sq ft

Lmin = 0.101 ft = 1.21 in

Rounded up to the nearest inch,

Lmin = 2 inches above the grout

Referenced from the 0'-0" concrete elevation, the minimum liner height is 14 inches + 2 inches for a total of 16 inches (Elevation 1' 4")